

PCTWORLD INTELLECTUAL PROPERTY ORGANIZATION
International Bureau

INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(51) International Patent Classification ⁶ : F16L	A2	(11) International Publication Number: WO 98/30823
		(43) International Publication Date: 16 July 1998 (16.07.98)

(21) International Application Number: PCT/GB98/00102

(22) International Filing Date: 12 January 1998 (12.01.98)

(30) Priority Data:
9700521.9 11 January 1997 (11.01.97) GB

(71) Applicant (for all designated States except US): SPECIALTY TOOLS LIMITED [GB/GB]; Unit 5, Altens Lorry Park, Hareness Road, Altens Industrial Estate, Aberdeen AB12 3LW (GB).

(72) Inventor; and

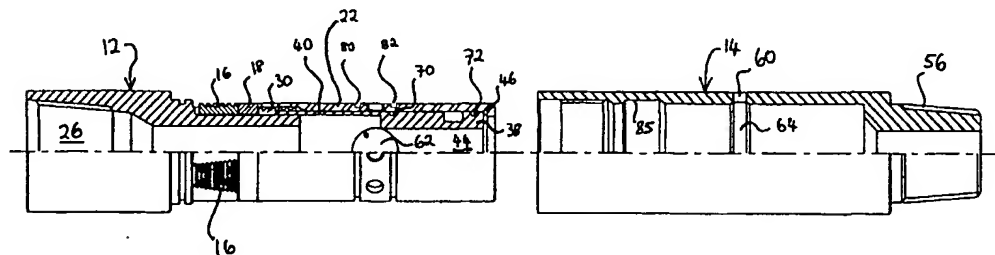
(75) Inventor/Applicant (for US only): HILLIARD, Paul [GB/GB]; 15 Drumthwacket Drive, Portlethen, Aberdeen AB12 4TU (GB).

(74) Agent: MURGITROYD & COMPANY; 373 Scotland Street, Glasgow G5 8QA (GB).

(81) Designated States: AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, CA, CH, CN, CU, CZ, DE, DK, EE, ES, FI, GB, GE, GH, GM, GW, HU, ID, IL, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MD, MG, MK, MN, MW, MX, NO, NZ, PL, PT, RO, RU, SD, SE, SG, SI, SK, SL, TJ, TM, TR, TT, UA, UG, US, UZ, VN, YU, ZW, ARIPO patent (GH, GM, KE, LS, MW, SD, SZ, UG, ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, CH, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, ML, MR, NE, SN, TD, TG).

Published*Without international search report and to be republished upon receipt of that report.*

(54) Title: CONNECTOR



(57) Abstract

A connector (10) is described as comprising a first body member (12) for connection (26) to a first entity, such as the end of a coiled tubing, and a second body member (14) for connection (56) to a second entity such as a Bottom-Hole Assembly (BHA). When the first (12) and second (14) body members are connected to the first and second entities respectively, the connector (10) forms a substantially rigid connection between the first and second entities and can transmit mechanical forces therebetween. The first (12) and second (14) body members are coupled by a first coupling arrangement (16) on the first body member (12) and a second coupling arrangement (16) on the second body member (14), said first coupling arrangement (16) comprising a plurality of discrete segments (16) having respective segment surfaces which together define a formation engageable with a formation (58) of the second coupling arrangement (58). A support means (40) normally retains the segments (16) in respective connection positions on the first body member (12) in which the respective segment surfaces collectively form the first coupling arrangement (16). A release means (62) is selectively operable to disable the support means (40) to cause or allow the segments (16) to be displaced from their respective connection positions so that they disengage from the second coupling arrangement (58) and thereby mutually disconnect the first (12) and second (14) body members of the connector (10). The first (16) and second (58) coupling arrangements are, preferably, respectively first (16) and second (58) screw thread surfaces.

FOR THE PURPOSES OF INFORMATION ONLY

Codes used to identify States party to the PCT on the front pages of pamphlets publishing international applications under the PCT.

AL	Albania	ES	Spain	LS	Lesotho	SI	Slovenia
AM	Armenia	FI	Finland	LT	Lithuania	SK	Slovakia
AT	Austria	FR	France	LU	Luxembourg	SN	Senegal
AU	Australia	GA	Gabon	LV	Latvia	SZ	Swaziland
AZ	Azerbaijan	GB	United Kingdom	MC	Monaco	TD	Chad
BA	Bosnia and Herzegovina	GE	Georgia	MD	Republic of Moldova	TG	Togo
BB	Barbados	GH	Ghana	MG	Madagascar	TJ	Tajikistan
BE	Belgium	GN	Guinea	MK	The former Yugoslav Republic of Macedonia	TM	Turkmenistan
BF	Burkina Faso	GR	Greece			TR	Turkey
BG	Bulgaria	HU	Hungary	ML	Mali	TT	Trinidad and Tobago
BJ	Benin	IE	Ireland	MN	Mongolia	UA	Ukraine
BR	Brazil	IL	Israel	MR	Mauritania	UG	Uganda
BY	Belarus	IS	Iceland	MW	Malawi	US	United States of America
CA	Canada	IT	Italy	MX	Mexico	UZ	Uzbekistan
CF	Central African Republic	JP	Japan	NE	Niger	VN	Viet Nam
CG	Congo	KE	Kenya	NL	Netherlands	YU	Yugoslavia
CH	Switzerland	KG	Kyrgyzstan	NO	Norway	ZW	Zimbabwe
CI	Côte d'Ivoire	KP	Democratic People's Republic of Korea	NZ	New Zealand		
CM	Cameroon			PL	Poland		
CN	China	KR	Republic of Korea	PT	Portugal		
CU	Cuba	KZ	Kazakhstan	RO	Romania		
CZ	Czech Republic	LC	Saint Lucia	RU	Russian Federation		
DE	Germany	LI	Liechtenstein	SD	Sudan		
DK	Denmark	LK	Sri Lanka	SE	Sweden		
EE	Estonia	LR	Liberia	SG	Singapore		

1 "Connector"

2

3 This invention relates to a connector, and relates more
4 particularly but not exclusively to a connector for
5 connecting coiled tubing to a Bottom Hole Assembly
6 (BHA) in a manner allowing for selective action at a
7 remote location to cause the connector to disconnect
8 the coiled tubing from the BHA.

9

10 Coiled tubing is a form of non-rigid hollow pipe
11 designed for use in well bores to transmit mechanical
12 torque and tension from a surface location to a BHA or
13 other downhole entity, and to convey hydraulic fluid at
14 pressure along the hollow interior of the tubing. At
15 the same time (and unlike a conventional rigid
16 drillstring), coiled tubing has sufficient flexibility
17 to allow a substantial length of tubing to be stored on
18 a reel in the manner of a hose. (This gives rise to
19 the term "coiled"; in normal use, "coiled" tubing is
20 de-coiled and is more or less straight, at least when
21 in a wellbore).

22

23 With the continued and increasing use of coiled tubing
24 for drilling, milling and workover applications in
25 oilfield well-bores there is a need for more reliable

1 and robust equipment which can be attached to the end
2 of coiled tubing depending on the application and the
3 work which is to be performed in the well-bore. Such
4 equipment and tools are generally termed the "Bottom
5 Hole Assembly" or "BHA". On the majority of coiled
6 tubing jobs, irrespective of application or equipment
7 being used, there is the potential for the BHA to
8 become stuck in the well-bore. In order to help
9 alleviate the problems this can cause, certain
10 "emergency release" tools are available which can be
11 used along with the BHA. These emergency release tools
12 or "disconnects" are widely available from many
13 suppliers and are fairly generic in design and method
14 of activation. This familiarity and common design has
15 the advantage that people are familiar in the way they
16 operate and perform so eliminating potential problems
17 that might arise from unfamiliarity with different
18 methods of operation.

19
20 Disconnect tools are only utilised in an emergency
21 situation if the BHA becomes stuck and the coiled
22 tubing cannot be removed from the well-bore. The
23 disconnect allows the coiled tubing to be safely parted
24 at a known point within or adjacent the BHA, thus
25 permitting the coiled tubing to be removed from the
26 well-bore and a 'fishing' string to be used to remove
27 the stuck tools separately. This fishing string would
28 latch into a retrieval profile on the lower half of the
29 disconnect tool with a specifically designed pulling
30 tool.

31
32 In order to activate the disconnect tool, most known
33 designs require a ball of specific size to be dropped
34 from the surface through the coiled tubing until it
35 reaches a ball seat within the disconnect. Once the
36 ball has reached the disconnect, fluid flow is no

1 longer possible through the coiled tubing. At this
2 point the internal hydraulic pressure in the coiled
3 tubing is increased to activate the release mechanism
4 within the disconnect. This allows controlled
5 separation of the upper and lower parts of the
6 disconnect.

7
8 Conventional disconnect tools comprise two body members
9 which are rotationally coupled together by a torque
10 clutch mechanism in the form of corresponding
11 castellations mounted on each coupling face of the body
12 members. The conventional disconnect tools are
13 longitudinally coupled by sprung outwardly loaded
14 fingers which extend through the inner bore from one of
15 the body members, over the castellated coupling, and
16 latch onto a recess on the inner bore of the other body
17 member.

18
19 The sprung outwardly loaded fingers are further pushed
20 out, prior to disconnect, by a moveable piston which
21 seats the fingers into the recess. When a ball is
22 introduced, it lands on the piston, and moves the
23 piston so that the fingers are no longer pushed into
24 the recess, and which can move inwardly when the two
25 body members are pulled apart, which disconnects the
26 two body members.

27
28 According to the present invention there is provided a
29 connector comprising first and second body members for
30 connection to respective first and second entities to
31 be connected together such that in use of the connector
32 when the first and second body members are connected to
33 the first and second entities respectively, the
34 connector forms a substantially rigid connection
35 between the first and second entities and is capable of
36 transmitting mechanical forces therebetween, the first

1 and second body members being mutually coupled by a
2 first coupling arrangement on the first body member and
3 a second coupling arrangement on the second body
4 member, said first coupling arrangement comprising a
5 plurality of discrete segments having respective
6 segment surfaces which together define a formation
7 engageable with a formation of the second coupling
8 arrangement, and support means to support the segments
9 in respective connection positions on the first body
10 member in which the respective segment surfaces
11 collectively form the first coupling arrangement, and
12 release means selectively operable to disable the
13 support means to cause or allow the segments to be
14 displaced from their respective connection positions
15 and disengage from the second coupling arrangement
16 thereby mutually disconnecting the first and second
17 body members of the connector.

18
19 Preferably, the first coupling arrangement is a first
20 screw thread surface, the second coupling arrangement
21 is a second screw thread surface, and the first and
22 second screw thread surfaces are engaged when the first
23 and second body members are connected.

24
25 Said segments may each be part-cylindrical. The
26 segment surfaces collectively forming the first screw
27 thread surface may be radially external surfaces of the
28 segments, with the segments being displaced from their
29 respective connection positions in respective
30 directions each including a respective radially inward
31 component. The support means may comprise a retainer
32 member to retain each segment in a respective radially
33 outwardly displaced position, and the release means may
34 comprise retainer withdrawal means selectively operable
35 to withdraw the retainer member from a segment-
36 retaining position so as to allow the segments to move

1 radially inwards and thereby disengage from the second
2 screw thread surface. The retainer member may comprise
3 wedges or slips insertable radially under each segment,
4 and withdrawable by an axial sliding movement. The
5 support means and the release means may be conjoined
6 into a single component or assembly including a
7 normally-open longitudinal through passage selectively
8 closable to allow the application of fluid pressure
9 sufficient to cause the axial sliding movement inducing
10 withdrawal of the retainer member from the segments.

11

12 The connector may comprise a capture means to catch
13 the support means after operation of the release means.
14 The capture means is preferable mounted on the first
15 body member.

16

17 The segments may be located, in use, within slots,
18 where the slots may be formed on the outer
19 circumference of the first body member. The segments
20 and their respective slots may comprise differing
21 circumferential extents. The segments and their
22 respective slots may comprise a varied width along
23 their longitudinal axis. The segments and their
24 respective slots may comprise tapered side edges which
25 taper in from the radially innermost surface of the
26 segments and their respective slots to the radially
27 outermost surface of the segments and their respective
28 slots.

29

30 Typically, the connector further comprises a load
31 bearing member which, in use of the connector, abuts an
32 end of the segments.

33

34 The first entity may be coiled tubing and the second
35 entity may be a bottom-hole assembly, the connector
36 functioning as a selectively operable disconnect for

1 separating the coiled tubing from the bottom-hole
2 assembly.

3

4 An embodiment of the invention will now be described by
5 way of example, with reference to the accompanying
6 drawings wherein:-

7

8 Figure 1 is an exploded half-sectional
9 longitudinal elevation of a preferred form of
10 connector in accordance with the invention;
11 Figure 2 is a half-sectional longitudinal
12 elevation of a sub-assembly of the connector;
13 Figure 3 is a cross-section of the sub-assembly of
14 Figure 2, taken on the line III-III in Figure 2;
15 Figure 4 is a cross-section equivalent to Figure 3
16 but showing the reconfiguration of components upon
17 disconnection of the connector;
18 Figure 5 is a half-sectional longitudinal
19 elevation of the sub-assembly of Figure 2 with a
20 further component assembled thereon to form one
21 half of the connector;
22 Figure 6 is a half-sectional longitudinal
23 elevation of the connector half of Figure 5 being
24 offered up to the other half of the connector;
25 Figure 7 is a half-sectional longitudinal
26 elevation of the fully assembled connector; and
27 Figure 8 is a half-sectional longitudinal
28 elevation of the connector in the process of
29 disconnecting.

30

31 Referring first to Figure 1, this is a half-sectional
32 longitudinal elevation of the mutually separated
33 components of a connector 10.

34

35 The components of the connector 10 comprise an upper
36 body member 12 and a lower body member 14, three part-

1 cylindrical segments 16 (only two of which are shown in
2 Figure 1), a load ring 18, a segment support 20, and a
3 retainer sleeve 22. (Further components, which are not
4 shown in Figure 1, will be detailed subsequently).

5
6 The upper body 12 is hollow and has a through bore 24
7 (not visible in Figure 1 but shown in Figures 3 and 4).
8 An end of the upper body 12 (the left end as viewed in
9 Figure 1), which will be the upper end of the connector
10 10 in use, is internally formed with a standard tapered
11 thread box connector 26 (not visible in Figure 1 but
12 shown in Figure 8). The other end of the upper body 12
13 is formed with three longitudinally extending slots 28
14 in its periphery, and a screw-threaded portion 30 which
15 is circumferentially interrupted by the slots 28.

16
17 The segments 16 each comprise a part-cylindrical
18 member, where the first, second and third segments 16
19 preferably respectively have a circumferential extent
20 of slightly less than, equal to, and slightly greater
21 than one-sixth of a revolution, and the respective
22 slots 28 are of a matching width. This ensures that
23 only one segment 16 will fit into, and be retained by,
24 each slot 28. The radially outer surface of each
25 segment 16 is formed with screw-threaded portions, as
26 an interrupted male thread whose lands correspond to
27 the angular width of each segment 16, the pitch circle
28 diameter of this segment thread being somewhat greater
29 than the pitch circle diameter of the thread on the
30 screw-threaded portion 30 of the upper body 12. Each
31 segment 16 has a circumferential extent which renders
32 it a sliding fit in a respective slot 28 (see Figures 3
33 and 4), and with each segment 16 only fitting in one
34 slot 28, this ensures that the interrupted male thread
35 formed thereby is always correctly formed.
36

1 Also, the slots 28 are preferably formed to have a
2 smaller gap at their upper most, in use, end than their
3 lower most end, and the segments 16 are preferably
4 formed with a correspondingly smaller width at their
5 uppermost end. This ensures that each segment 16 will
6 only fit in its respective slot 28 in one orientation,
7 thereby aiding correct assembly of the connector 10.
8 Also, each segment 16 is preferably formed with tapered
9 side edges 32 which are tapered from the radially
10 innermost to the outermost surface such that the width
11 of the radially innermost surface of the segment 16 is
12 greater than the width of the radially outermost
13 surface of the segment 16. The respective slots 28 are
14 preferably correspondingly tapered, which ensures that
15 each segment 16 is retained within its respective slot
16 28, and cannot fall radially outwardly therefrom.

17
18 The load ring 18 is annular, and comprises three ridges
19 (not shown) which project radially inward to an extent
20 to be a close but slidable fit with the outer surface
21 of fingers 40 (which will be detailed subsequently),
22 and which are circumferentially distributed to also lie
23 within the slots 28.

24
25 The segment support 20 comprises an annular portion 38
26 at its lower end (the right end as viewed in Figure 1)
27 from which three equi-spaced fingers 40 extend upwards
28 (to the left as viewed in Figure 1). The fingers 40
29 are each laterally curved at a constant radius about
30 the longitudinal axis of the segment support 20 (which
31 axis is coincident with the longitudinal axis of the
32 connector 10 as a whole). The inner surface of each
33 finger 40 is a sliding fit over the radially outer
34 surface of a respective slot 28, and the angular extent
35 of each finger 40 renders it an axially sliding fit in
36 its respective slot 28 (see Figure 3). The annular

1 portion 38 of the segment support 20 is formed with a
2 circumferentially extending external slot 42, for a
3 purpose to be detailed subsequently. The annular
4 portion 40 also has a through bore 44.

5
6 The retainer sleeve 22 is generally cylindrical in
7 form, with an inturned lip 46 at its lower end (the
8 right end as viewed in Figure 1). The inside diameter
9 of the sleeve 22 allows the segment support 20 to be an
10 axially sliding fit inside the sleeve 22 (see Figures
11 5-7), except that the inturned lip 46 catches the
12 annular portion 38 and thereby prevents the segment
13 support 20 sliding out of the retainer sleeve 22 when
14 the connector 10 is separating (see Figure 8). The
15 upper end of the sleeve 22 (the left end as viewed in
16 Figure 1) is internally formed with a screw thread 48
17 dimensioned for screw-threaded engagement with the
18 screw-threaded portion 30 on the upper body 12 when the
19 connector 10 is assembled (see Figures 5-7). A series
20 of threaded and non-threaded radially extending through
21 holes 50 are circumferentially distributed around the
22 sleeve 22 at about its mid-length. There are six
23 threaded holes 50 and three non-threaded holes 50
24 distributed around the sleeve 22, for a purpose to be
25 detailed subsequently. The inner surface of the sleeve
26 22 is relieved around the radially inner ends of the
27 holes 50 by means of a radially shallow circumferential
28 slot 52.

29
30 The components 12, 16, 18, 20 and 22 (together with
31 shear pins (not shown in Figure 1) which fit through
32 the threaded holes 50 and into the slot 42) are
33 assembled (as will subsequently be described) to form
34 the upper half of the connector 10. The lower body 14
35 per se forms the lower half of the connector 10, and
36 will now be described as a separate component.

1 The lower body 14 is a hollow cylinder and has a
2 through bore 54. An end of the lower body 14 (the
3 right end as viewed in Figure 1) which will be the
4 lower end of the connector 10 in use, is externally
5 formed with a standard tapered thread pin connector 56.
6 Near the upper end of the lower body 14 (the left end
7 as viewed in Figure 1), the lower body 14 is internally
8 formed with a screw thread 58 dimensioned for screw-
9 threaded engagement with the screw-threaded outer
10 surfaces of the segments 16 in the assembled connector
11 10, as will subsequently be detailed. A series of
12 radially extending non-threaded through holes 60 is
13 circumferentially distributed around the lower body 14
14 at about its mid-length. The inner surface of the
15 lower body 14 is relieved around the radially inner
16 ends of the non-threaded circulation holes 60 by means
17 of a radially shallow circumferential slot 64.

18
19 The non-threaded holes 60 of the lower body 14 allow
20 circulation of fluid to occur during separation of the
21 upper 12 and lower 14 bodies, and will be detailed
22 subsequently.

23
24 Assembly of the connector components will now be
25 described.

26
27 Starting with the individual components shown in Figure
28 1, the first few stages of connector assembly are
29 illustrated in Figures 2 and 3. The three segments 16
30 are slid into their respective slots 28; the preferable
31 form and co-operation of the segments 16 and slots 28
32 ensures that (a) each segment 16 can only correctly fit
33 within, and be retained by one slot 28, (b) each
34 segment 16 can only be inserted into its slot 28 in one
35 orientation, and (c) once fully inserted into its
36 respective slot, each segment 16 cannot fall radially

1 outwardly therefrom. The load ring 18 is then slid
2 over the lower (right) end of the upper body 12
3 (initially free of other components except for the
4 three segments 16) until the three ridges of the load
5 ring 18 are located within the lower (right) end of
6 each slot 28. The load ring 18 is further slid (from
7 right to left) until its uppermost end butts the
8 lowermost (widest) ends of the segments 16. Thus,
9 there is a gap between the radially innermost surface
10 of the ridges and their respective slot 28, into which
11 the respective finger 40 can be slid. Next, the
12 segment support 20 is fitted over the lower end of the
13 upper body 12 such that the fingers 40 slide along the
14 slots 28, until the annular portion 38 abuts the lower
15 end of the upper body 12. At the same time, the
16 fingers 40 have slid through the gap between the ridges
17 of the load ring 18 and the slots 28, and have also
18 slid between the radially innermost surface of the
19 segments 16 and the slots 28. The upper end of the
20 load ring 18 thus provides a load bearing surface for
21 the segments 16, and also prevents them from sliding
22 (from left to right) out of their respective slot 28.
23 The part-assembled configuration is illustrated in
24 Figure 2 (elevation) and in Figure 3 (cross-section).

25
26 It should be noted at this point that segments 16, the
27 slots 28, and the fingers 40 are such that when the
28 fingers 40 are fully inserted into the slots 28, the
29 segments 16 are held radially outwards to an extent
30 that their threaded outer surfaces stand proud of the
31 upper body 12 as particularly shown in Figure 3.
32 However, when the fingers 40 are axially withdrawn from
33 the slots 28, the segments 16 are no longer held
34 radially outwards, and it becomes feasible for the
35 threaded outer surfaces of the segments 16 to retract
36 radially inwards to lie substantially flush with the

1 upper body 12, as particularly shown in Figure 4.

2

3 As the next step in the assembly of the connector 10,
4 the retainer sleeve 22 is screwed on to the
5 intermediate sub-assembly shown in Figure 2, such that
6 the internal thread 48 on the sleeve 22 forms a screw-
7 threaded connection with the circumferentially
8 interrupted thread of the screw-threaded portion 30 on
9 the upper body 12. When the screw threads 30 and 48
10 are fully engaged, the upper end of the retainer sleeve
11 22 (the left end as viewed in Figures 1 and 5) butts
12 against the lower end of the load ring 18, and the
13 upper end of the load ring 18 butts against the lower
14 end of the segments 16 as shown in Figure 5. For the
15 time being, the segments 16 are supported in the
16 particular places on the exterior of the upper body 12,
17 with the underlying fingers 40 of the segment support
18 20 holding the segments 16 radially outwards, the load
19 ring 18 and the slots 28 together providing axial
20 restraint while also preventing the segments 16
21 escaping radially outwards. It is arranged that when
22 so anchored, the threaded outer surfaces of the
23 segments 16 collectively form a screw thread for
24 eventual connection with the screw thread 58 in the
25 lower body 14.

26

27 To obviate premature withdrawal of the fingers 40 from
28 under the segments 16, the segment support 20 is locked
29 into place within the screwed-on retainer sleeve 22 by
30 means of shear pins (not shown) which are screwed into
31 the threaded holes 50 (which are internally threaded
32 for this purpose) so as to project radially inwards of
33 the holes 50 and into the slot 42 around the annular
34 portion 38 forming the lower end of the segment support
35 20.

36

1 The upper half of the connector 10 is now assembled and
2 ready for mating with the lower half (constituted by
3 the lower body 14).

4
5 Referring next to Figure 6, the upper half of the
6 connector 10 (constituted by the Figure 5 assembly) is
7 presented to the lower body 14, lower end to upper end
8 respectively. The two halves are slid together along
9 their common longitudinal axis until the segments 16 on
10 the upper half contact the internal thread 58 on the
11 lower body 14, whereupon the two halves are relatively
12 rotated to complete the screw-threaded mutual coupling
13 of the two halves of the connector 10, as shown in
14 Figure 7. The two halves are relatively rotated up to
15 a pre-determined torque, the level of which will
16 normally be the same as, or higher than the torque
17 value of the rest of the screw connections in the
18 string.

19
20 The completed connector 10 (as shown in Figure 7) can
21 have the box connector 26 at the upper end of the
22 coupling 10 connected to the lower end of a coiled
23 tubing (not shown), and the pin connector 56 at the
24 lower end of the connector 10 connected to a BHA
25 (Bottom-Hole Assembly; not shown). Thereby the
26 connector 10 couples the coiled tubing to the BHA in a
27 mechanically rigid manner, which is optimal for
28 downhole use, while also providing a through passage
29 for pressurised hydraulic fluid by way of the bores 24,
30 44 and 54. At the same time, the connector 10 allows
31 for disconnection of the coiled tubing from the BHA by
32 action taken on the surface above the well, at a time
33 of the operator's choosing and by a standard procedure,
34 as will now be described.

35
36 Referring to Figure 8, when it is desired to separate

1 the two halves of the connector 10, a dropball 62 of
2 suitable size is introduced into the bore of the coiled
3 tubing at the surface installation above the wellbore
4 in which the connector 10 is deployed. The dropball 62
5 travels through the bore of the coiled tubing along the
6 length of the tubing, and eventually reaches the
7 connector 10 where it passes through the box connector
8 26 and the bore 24, coming to rest against the annular
9 portion 38 at the lower end of the segment support 20.
10 The bore 44 through the annular portion 38 is selected
11 to be sufficiently smaller (typically one three
12 thousandth of an inch) than the bore of the coiled
13 tubing, and sufficiently smaller than the bore 24
14 through the upper body 12, that a dropball 62 of
15 predetermined dimensions can readily reach the interior
16 of the connector 10 but will inevitably be trapped
17 against the lower end of the segment support 20.

18
19 With hydraulic passage through the connector 10 blocked
20 by seating of the dropball 62 against the upper rim of
21 the bore 44 through the segment support 20 (as
22 particularly shown in Figure 8), enough hydraulic
23 pressure can readily be applied down the coiled tubing
24 leading to the upper end of the connector 10 that the
25 piston effectively formed by the combination of segment
26 support 20 and dropball 62 exerts a force on the shear
27 pins projecting radially inwards from the threaded
28 holes 50 into the slot 42 around the segment support 20
29 sufficient to break these shear pins and so release the
30 segment support 20 from being locked to the retainer
31 sleeve 22. The same hydraulic pressure in the
32 effective piston 20 will force the piston (dropball-
33 blocked segment support) 20 down the sleeve 22, so
34 dragging the fingers 40 down the slots 28 until the
35 fingers 40 no longer underlie the segments 16. Now
36 free of radially outward support, the segments 16 will

1 tend to move radially inwards under their wedging
2 interaction with the screw thread 58, so taking up the
3 positions shown in Figure 4. Once the segments 16 are
4 free of the screw thread 58, the upper and lower halves
5 of the connector 10 are no longer rigidly coupled, and
6 are free to move apart as depicted in Figure 8.

7
8 However, after the shear pins have been sheared, but
9 before the two halves have reached the level of
10 separation as depicted in Figure 8, the connector 10
11 has the ability to circulate fluid from the bore 24
12 above the piston 20, through the space between the
13 fingers 40, around the circumferential slot 52 on the
14 sleeve 22, through the three non-threaded circulation
15 holes 50 in the sleeve 22, around the circumferential
16 slot 64 on the lower body 14, and out through the non-
17 threaded circulation holes 60 in the lower body 14 into
18 the annulus between the outer surface of the connector
19 10 and the inner surface of the borehole.

20
21 If shear pins have not been inserted into some of the
22 threaded holes 50, then these threaded holes 50 will
23 also aid the circulation of fluid. This circulation of
24 fluid can occur from the time when upper 'O' ring seal
25 70 mounted in the segment support 20 moves downwardly
26 past the threaded and non-threaded holes 50 in the
27 sleeve 22, until lower 'O' ring seal 82 mounted on the
28 sleeve 22 moves upwardly past the non-threaded holes 60
29 in the lower body 14. Prior to the ball 62 being
30 dropped down the coiled tubing, the upper 70, 80 and
31 the lower 72, 82 'O' ring seals prevent fluid
32 communication between the bore 24 of the connector 10,
33 and the annulus of the borehole.

34
35 The advantage of this circulation function is that the
36 pressure drop of fluid upon commencement of circulation

1 gives an indication to the operator at the surface that
2 the shear pins have been sheared, and the tool is in
3 the process of disconnecting.

4

5 This axial separation of the connector halves is not
6 limited, and ultimately the two halves of the connector
7 10 will completely separate, so releasing the coiled
8 tubing from the BHA.

9

10 A retrieval profile 85 is formed on the interior,
11 toward the upper end, of the lower body 14, and after
12 the coiled tubing and upper body 12 have been removed
13 from wellbore, a fishing tool can be inserted into the
14 wellbore to latch onto the retrieval profile 85.

15

16 Considered as both a connector for normal use, and an
17 emergency disconnect tool, the various embodiments can
18 yield the following advantages over the prior art:-

19

- 20 1 Behaves like a conventional threaded connection
21 until tool is activated;
- 22 2 Provides torsional and tensile properties of
23 conventional threaded connection;
- 24 3 Elimination of clutches for torque transmission
25 ensures maximum strength under high vibrational
26 loading;
- 27 4 Strength and tool life extended due to elimination
28 of vibration on key load-bearing parts;
- 29 5 Improved ease of use in the field due to minimum
30 number of parts and no requirement for specialised
31 equipment for assembly or dis-assembly;
- 32 6 Circulation regained once tool is activated giving
33 surface indication that tool has functioned and
34 allowing acid etc to be pumped if required;
- 35 7 No overpull required to separate upper and lower
36 sections once the tool has been activated;

- 1 8 Short overall length allows it to be used in areas
2 where height restrictions exist;
3 9 Design allows large through bore whilst
4 maintaining optimum strength;
5 10 No internal parts remain in the lower body
6 following disconnect, ensuring easy entry by
7 subsequent fishing equipment; and
8 11 Standard retrieval tool can be used to latch on to
9 the lower body.

10

11 While a preferred embodiment of the invention has been
12 described above, the invention is not restricted
13 thereto. For example, a suitable number of segments
14 other than three could be utilised, and alternative
15 shapes of segment supports are possible. Further, the
16 support means could be formed from a suitable alloy
17 known from the art which is dissolved to a substantial
18 extent by passing an electrical current through the
19 connector 10, thus obviating the requirement to drop
20 the ball 62 in order to operate the segment support 20
21 to disable the fingers 40. Alternatively, the fluid
22 pressure within the bore of the coiled tubing can be
23 increased by a large degree such that the segment
24 support 20 is displaced without the requirement to drop
25 the ball 62. Other modifications and variations can be
26 adopted without departing from the scope of the
27 invention.

28

29

1 CLAIMS

2
3 1. A connector (10) comprising a first and second
4 body members (12) for connection (26) to respective
5 first and second entities to be connected together such
6 that in use of the connector (10) when the first (12)
7 and second (14) body members are connected to the first
8 and second entities respectively, the connector (10)
9 forms a substantially rigid connection between the
10 first and second entities and is capable of
11 transmitting mechanical forces therebetween, the first
12 (12) and second (14) body members being mutually
13 coupled by a first coupling arrangement (16) on the
14 first body member (12) and a second coupling
15 arrangement (58) on the second body member (14), said
16 first coupling arrangement (16) comprising a plurality
17 of discrete segments (16) having respective segment
18 surfaces which together define a formation engageable
19 with a formation (58) of the second coupling
20 arrangement (58), and support means (40) to support the
21 segments (16) in respective connection positions on the
22 first body member (12) in which the respective segment
23 surfaces collectively form the first coupling
24 arrangement, and release means (38) selectively
25 operable to disable the support means (40) to cause or
26 allow the segments (16) to be displaced from their
27 respective connection positions and disengage from the
28 second coupling arrangement (58) thereby mutually
29 disconnecting the first (12) and second (14) body
30 members of the connector (10).

31
32 2. A connector (10) according to claim 1, wherein the
33 first coupling arrangement (16) is a first screw thread
34 surface, the second coupling arrangement (58) is a
35 second screw thread surface (58), and the first and
36 second screw thread surfaces (58) are engaged when the

1 first (12) and second (14) body members are connected.

2

3 3. A connector (10) according to either of claims 1
4 or 2, wherein said segments (16) may each be part-
5 cylindrical.

6

7 4. A connector (10) according to either of claim 2 or
8 claim 3 when dependent on claim 2, wherein the segment
9 surfaces collectively forming the first screw thread
10 surface are radially external surfaces of the segments
11 (16), with the segments (16) being displaced from their
12 respective connection positions in respective
13 directions each including a respective radially inward
14 component.

15

16 5. A connector (10) according to any of the preceding
17 claims, wherein the support means (40) comprises a
18 retainer member (40) to retain each segment (16) in a
19 respective radially outwardly displaced position.

20

21 6. A connector (10) according to claim 5, wherein the
22 release means (38) comprises retainer withdrawal means
23 selectively operable to withdraw the retainer member
24 (40) from a segment-retaining position so as to allow
25 the segments (16) to move radially inwards and thereby
26 disengage from the second screw thread surface (58).

27

28 7. A connector (10) according to claim 6, wherein the
29 retainer member (40) comprises wedges (40) insertable
30 radially under each segment (16), and withdrawable by
31 an axial sliding movement.

32

33 8. A connector (10) according to claim 7, wherein the
34 support means (40) and the release means (38) are
35 conjoined into a single component (20) or assembly (20)
36 including a normally-open longitudinal through passage

1 (44) selectively closable to allow the application of
2 fluid pressure sufficient to cause the axial sliding
3 movement inducing withdrawal of the retainer member
4 (40) from the segments (16).

5
6 9. A connector (10) according to any of the preceding
7 claims, wherein the first entity is coiled tubing and
8 the second entity is a bottom-hole assembly, the
9 connector (10) functioning as a selectively operable
10 disconnect for separating the coiled tubing from the
11 bottom-hole assembly.

12
13 10. A connector (10) according to any of the preceding
14 claims, further comprising a capture means (22) to
15 catch the support means (40) after operation of the
16 release means (38).

17
18 11. A connector (10) according to claim 10, wherein
19 the capture means (22) is mounted on the first body
20 member (12).

21
22 12. A connector (10) according to any of the preceding
23 claims, wherein the segments (16) are located, in use,
24 within slots (28).

25
26 13. A connector (10) according to claim 12, wherein
27 the slots (28) are formed on the outer circumference of
28 the first body member (12).

29
30 14. A connector (10) according to claim 13, wherein
31 the plurality of segments (16) and their respective
32 slots (28) comprise differing circumferential extents.

33
34 15. A connector (10) according to any of claims 12 to
35 14, wherein the segments (16) and their respective
36 slots (28) comprise a varied width along their

1 longitudinal axis.

2

3 16. A connector (10) according to any of claims 12 to
4 15, wherein the segments (16) and their respective
5 slots (28) comprise tapered side edges which taper in
6 from the radially innermost surface of the segments
7 (16) and their respective slots (28) to the radially
8 outermost surface of the segments (16) and their
9 respective slots (28).

10

11 17. A connector (10) according to any of the preceding
12 claims, further comprises a load bearing member (18)
13 which, in use of the connector (10), abuts an end of
14 the segments (16).

15

16

17

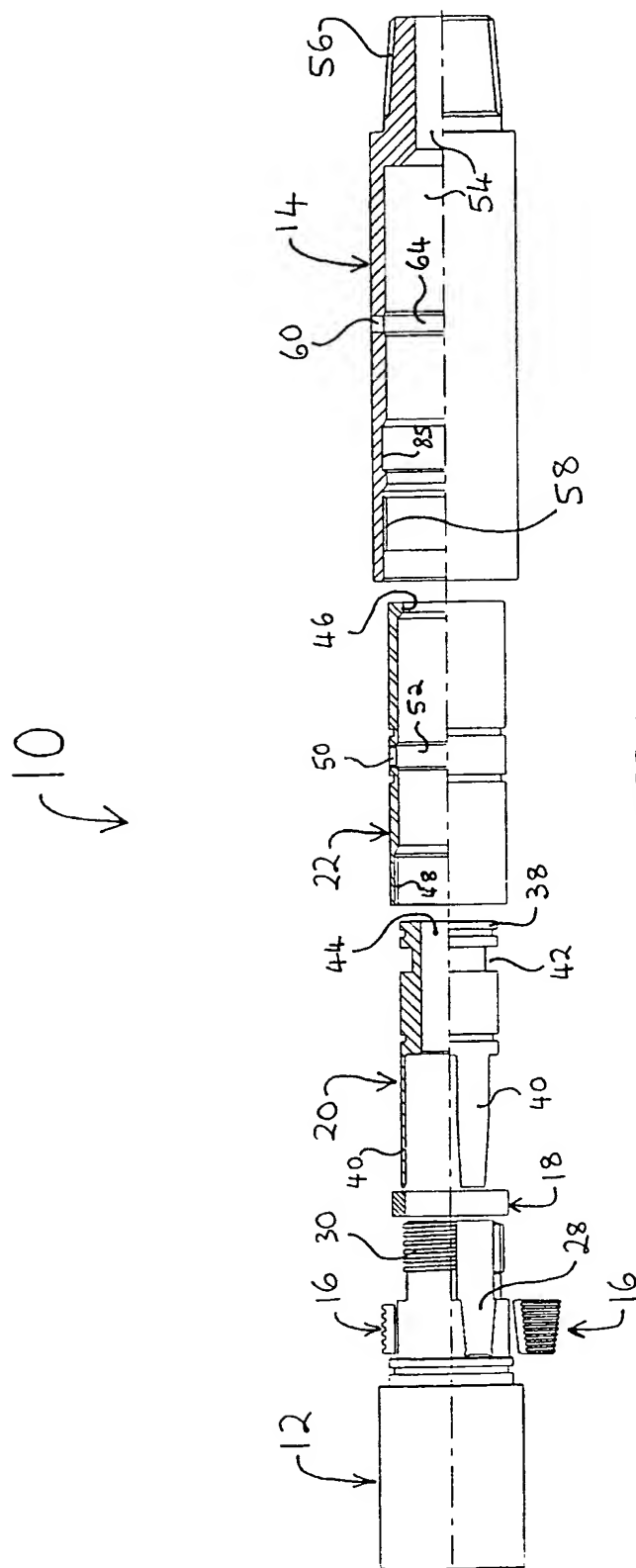


FIGURE 1

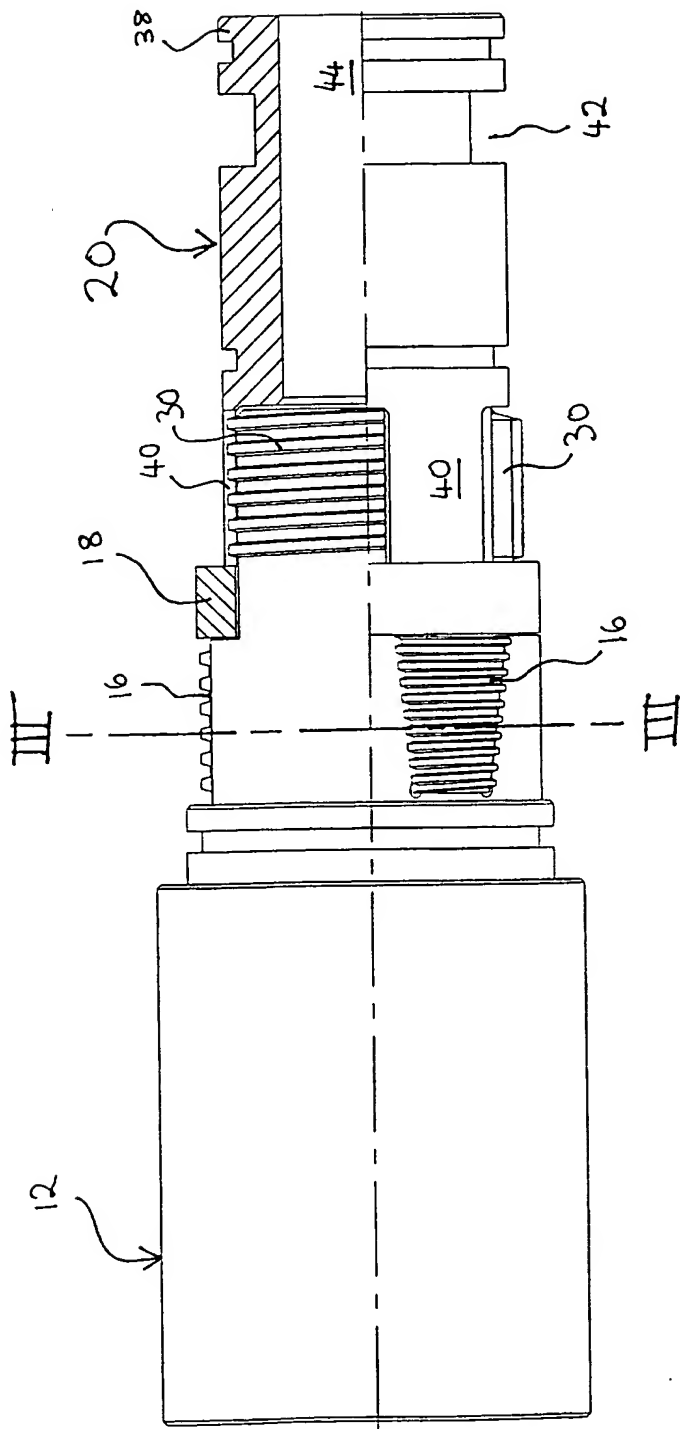


FIGURE 2

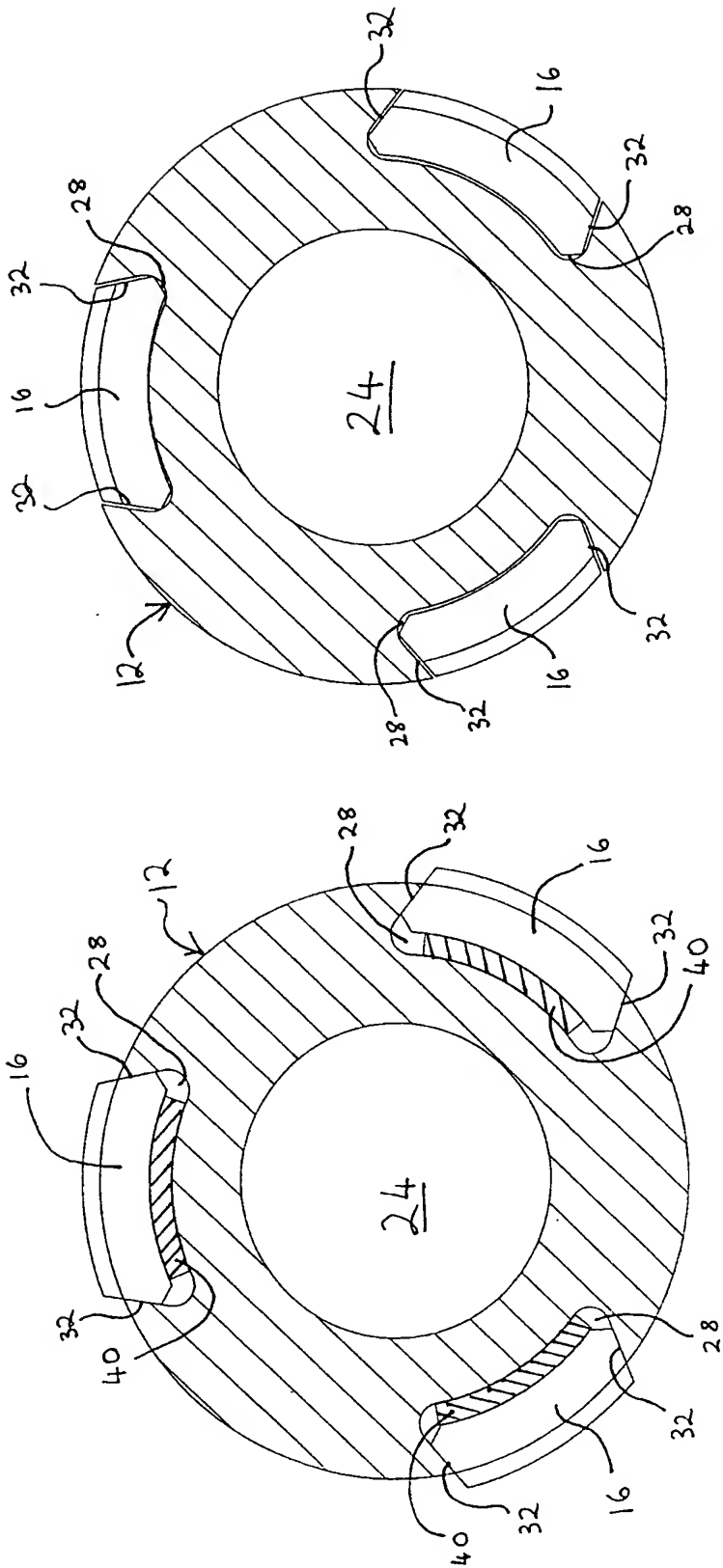


FIGURE 4

FIGURE 3

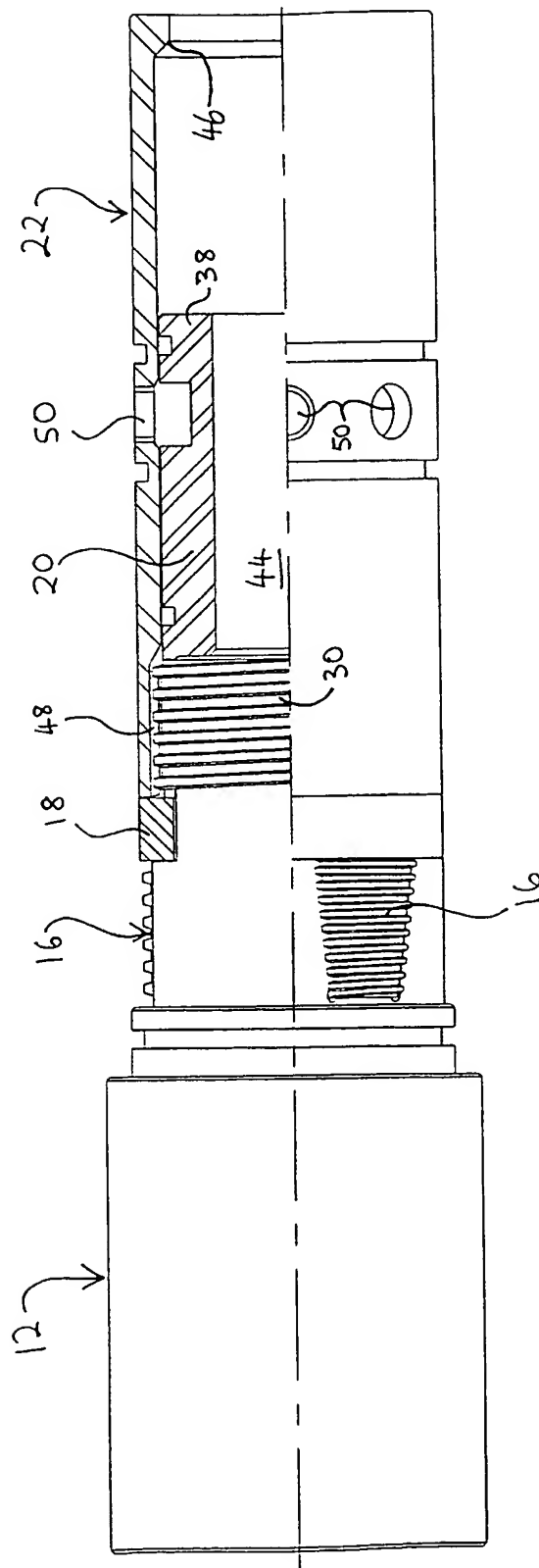
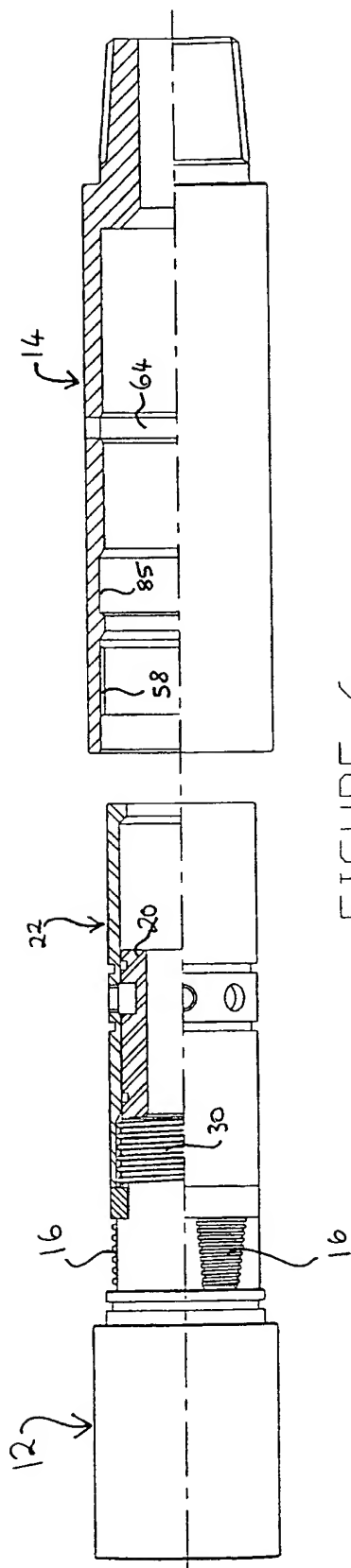


FIGURE 5

5/7



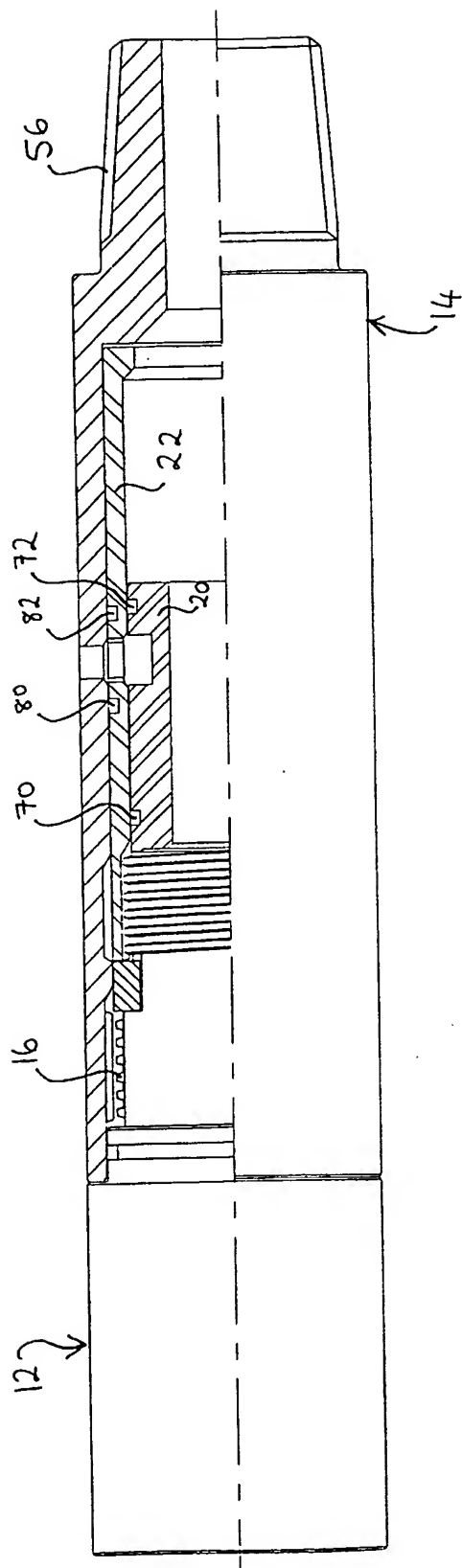


FIGURE 7

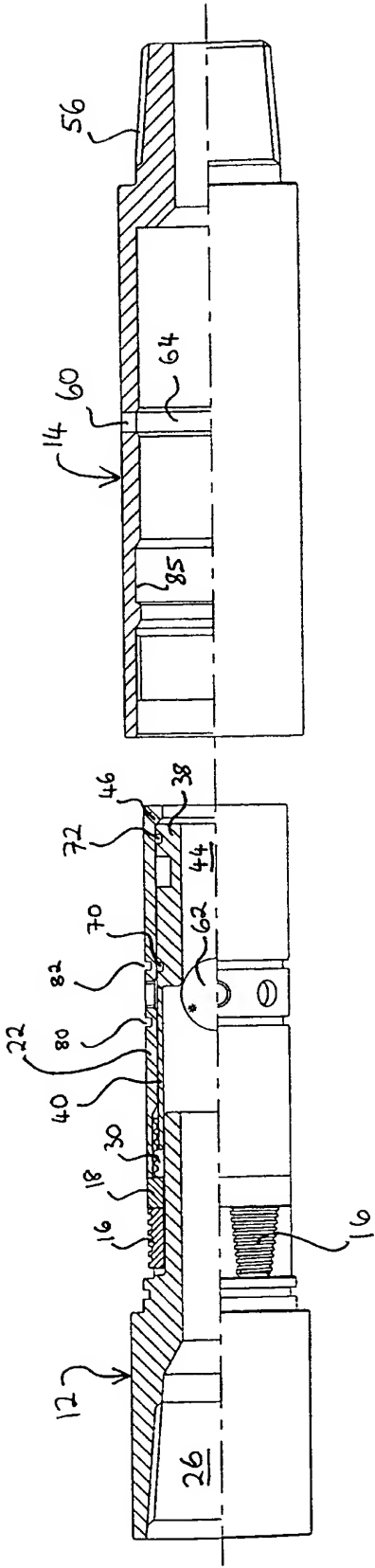


FIGURE 8